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RECORD OF ORAL HEARING

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte TAKAHIRO HAMADA, YUTAKA MABUCHI,
MAKOTO KANO, and YUUJI AZUMA

Appeal 2008-2351
Application 10/823,773
Technology Center 3700

Oral Hearing Held: October 21, 2008

Before LINDA E. HORNER, ANTON W. FETTING, and MICHAEL W. O'NEILL, Administrative Patent Judges

ON BEHALF OF THE APPELLANT:

PAUL STRAIN, ESQUIRE
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The above-entitled matter came on for hearing on Tuesday, October 21, 2008, commencing at 1:40 p.m., at the U.S. Patent and Trademark Office, 600 Dulany Street, Alexandria, Virginia, before Laurie Allen, Notary Public.

P R O C E E D I N G S

JUDGE HORNER: Good afternoon.

MR. STRAIN: Good afternoon. Hopefully we won't get called out of here in the middle of this. I don't know if you can hear the fire alarm in the other part of the building.

JUDGE HORNER: Oh, no. Let us hope not. If -- before we get started, if you have a business card that you can provide to the court reporter, we would appreciate it.

(Pause.)

JUDGE HORNER: And we have had an opportunity to look at your briefs, and to look at your case, so proceed when you are ready.

MR. STRAIN: Okay. I will make sure the reporter is ready, as well.

So, this is an interesting case for me, personally. I got my start in patent law, got my initial interest in patent law, working in research at a Department of Energy lab on fuel injectors, of all things, which is part of the subject matter in this case. I came over to the Patent Office and started my career at the Patent Office examining coating technologies. This case kind of brings full circle some of my initial experiences in patent law.

We are here today to talk about, essentially, two sets of rejections, the first set of rejections based upon a reference called Dam, and a second set of rejections based upon a primary reference to Coffinberry.

From the outset, I have found it's been my general experience that the questions from the board have the most value to the oral proceeding. And,

at least initially, if you have got any questions, having reviewed the briefs -- again, for us, we drafted the briefs over a year-and-a-half ago, so over the last several days I have been looking through the briefs to get back up to speed on the case, but I am familiar with the issues.

If you would prefer, we can start out -- and I would be happy to answer any initial questions that you have, and then I can make some points regarding the outstanding rejections, as well.

JUDGE HORNER: I have got one or two questions.

MR. STRAIN: Sure.

JUDGE HORNER: With the Dam reference -- and I will point you to the column and line number -- column 5 --

MR. STRAIN: Okay.

JUDGE HORNER: -- around line 43, there is a paragraph that talks about "control of some or all of the physical properties of the thin film coatings and coated substrate, other than thickness, are also important to producing a highly reliable needle member."

And then, they give examples of other physical properties, and they include "surface texture" in that list. Is that the same as the "surface roughness" in your claim?

MR. STRAIN: Not necessarily, though texture does have an impact on roughness. You could have something that had micro-indentations or wells or micro-grooves. That's used in low-friction applications from time to time. Those would be structural deviations that were intentionally put in place, and weren't part of, for example, the coating process itself. It adds to lubrication.

What happens is you have these micro-wells that are formed, in which lubricants can collect, or gather, and then be distributed during frictional movement between two parts.

JUDGE O'NEILL: So, is roughness the result of the character of the material that is being applied, versus the surface texture is somehow machined on?

Or what is the difference between texture and roughness in this art?

MR. STRAIN: In the low-friction art?

JUDGE O'NEILL: In –

MR. STRAIN: In the fuel injection art?

JUDGE O'NEILL: In -- for one of ordinary skill in the art, if they saw two terms, would they consider them synonyms or would they not consider them synonyms?

MR. STRAIN: There could be some overlap.

JUDGE O'NEILL: There could be some overlap?

MR. STRAIN: There could be some overlap. There are certainly applications aimed at reducing friction where there are grooves that are intentionally placed in two parts that are in contact with each other, or micro-indentations or wells in which a lubricant or lubricating material or solvent could collect on that surface.

JUDGE O'NEILL: Well –

MR. STRAIN: So there are things that are not identical, but for which there might be some overlap. Ultimately, in frictional applications, you are looking at the outer surface, not the coating itself, and you're not looking,

necessarily, at the underlying substrate, except to the extent that the underlying substrate provides some kind of texture to the coated material.

JUDGE O'NEILL: So there -- they are not -- are they -- they are not mutually exclusive? They are –

MR. STRAIN: I don't think they would necessarily be.

JUDGE O'NEILL: Okay. Because I am just trying to -- if we were to take, for example, a piece of sandpaper –

MR. STRAIN: Sure.

JUDGE O'NEILL: -- what would correlate -- the sandpaper has roughness, but also has texture. And I am trying to correlate what one of ordinary skill in this art would consider texture, versus roughness.

I mean, is it like I said, is the texture something that is -- we will say it is maybe machined into the parts, or -- versus the roughness, as if you spray the part, or you coat the part, it will, because of the particle size of whatever you are coating, you will automatically have a roughness, because of just the way the part is coated?

MR. STRAIN: You could have both, both phenomenon could occur and contribute to the overall surface roughness –

JUDGE O'NEILL: Oh, so –

MR. STRAIN: -- of the substrate.

JUDGE O'NEILL: So –

MR. STRAIN: So both could actually happen in concert. You could have a rough substrate onto which you have deposited material that has its own roughness, and then the surface of the material would have a surface

roughness that includes both the texture of the underlying substrate and the texture of the coating material.

JUDGE O'NEILL: So then, roughness is a broader version? It includes not only the deposit of the chemical compounds, it can also include the possibility of the surface itself as being –

MR. STRAIN: Yes.

JUDGE O'NEILL: Okay.

MR. STRAIN: I think that would be a reasonable interpretation. I don't know that I am necessarily a person of skill in the art. I may be of elevated skill in the art, having seen this maybe too much, but I would take into account, when talking about surface roughness, both texture and the roughness in a given area.

JUDGE O'NEILL: So -- because when you machine -- say you machine a part. You are going to have a texture, just because of the way the part is machined.

MR. STRAIN: You will.

JUDGE O'NEILL: Then, when you coat the part, you are going to have, you know, roughness, due to the -- it will be on the micro level, because -- just because of the size of the particles that you are using to apply --

MR. STRAIN: Certainly. And that is something in the coating art. As you increase magnification, something that appears to have a mirror finish –

JUDGE O'NEILL: Right.

MR. STRAIN: -- may, in fact, have micro or nano-level roughness at a certain magnification. At some level of magnification -- say we are using an atomic-force microscope -- you would see each individual atom as a part on the substrate.

So, for example, depositing carbon, you're not necessarily depositing large particles of carbon, you are -- if you are using sputtering, for example, and literally blasting away carbon atoms or clusters of carbon atoms from a sputtering target, which would then deposit onto the substrate, your roughness is going to take into account the size of the particles that are being ablated by the laser.

If you are using chemical vapor deposition, then you may have methane or another gas that is in the chamber, and you may have something that is closer to, really, atomic-level individual atom-level deposition on the substrate, in which case you're not going to have particle bumps, you're going to have bumps on, perhaps, the atomic level.

JUDGE O'NEILL: Right. Okay.

MR. STRAIN: So, depending on the coating thickness, the coating material, it can impact the extent to which, for example, the imperfections or bumps in a substrate -- in an example like the snow –

JUDGE O'NEILL: Okay.

MR. STRAIN: -- you can have the side of a mountain -- we are coming up on ski season, there are a lot of rocks. But as the snow accumulates, even though it is fine, individual snowflakes, eventually something can get covered over, and a surface on the side of a mountain can

look flat, when, in reality, there are a bunch of jagged peaks and rocks and boulders and trees and other things that are hidden beneath.

JUDGE O'NEILL: And would the snow surface be the roughness, and then the –

MR. STRAIN: The surface roughness that we're talking about for the purposes of this claim is the top surface.

JUDGE O'NEILL: Okay.

MR. STRAIN: It's the top surface, because that is what is in contact with the counterpart surface.

JUDGE O'NEILL: Okay.

MR. STRAIN: So it is the smoothness of the top surface, regardless of what is underneath –

JUDGE O'NEILL: Okay.

MR. STRAIN: -- that will ultimately define the extent to which things engage in frictional coupling at the surface interface level.

JUDGE O'NEILL: Well, that education –

JUDGE HORNER: I had a question regarding Coffinberry.

MR. STRAIN: Sure.

JUDGE HORNER: Okay. I believe one of the arguments you had made in the brief was that Coffinberry does not disclose a needle valve member.

MR. STRAIN: Sure, that's right.

JUDGE HORNER: And I wanted to point you to column four of Coffinberry.

MR. STRAIN: Are you looking at line 65?

JUDGE HORNER: Yes. Yes, I am.

MR. STRAIN: The reference to fuel injector?

JUDGE HORNER: Yes, and why –

MR. STRAIN: If you –

JUDGE HORNER: Why wouldn't the disclosure of using the invention, or the coating of Coffinberry on a fuel injector surface at –

MR. STRAIN: The –

JUDGE HORNER: -- least suggest it could be used on a needle valve member?

MR. STRAIN: Well, first -- and I will point back briefly to the top of column 3, or the paragraph that bridges columns 2 and 3, particularly to lines, say, 12 to 14 -- Coffinberry is really ultimately focused on jet and gas turbine engines.

And the fuel injection systems that are used for that are different than automotive fuel injection systems. A number of the automotive fuel injection systems use pin structure valves, where the pin is withdrawn from the opening, and as it's withdrawn, it opens an increasingly larger cross-section of the opening, and allows fuel to flow.

There are certainly differences, given the art area, that would not automatically suggest that you are using the same kind of valve in a fuel injector for a gas turbine or jet engine that you would use for an automotive application, in which you would have a piston pin structure -- or not a piston pin, but a pin-based valve structure.

JUDGE HORNER: But could you see the purpose of the coating surface of Coffinberry having applicability to automotive fuel injectors?

MR. STRAIN: Coffinberry is really focused on the build-up of coke, which is part of the combustion process. And to the extent that the combustion is not occurring within the fuel injector, I would be inclined -- and were I someone skilled in the art -- I would be more inclined to coat an exterior surface of the fuel injector that is actually at the interface of the combustion chamber, and I would coat the exterior –

JUDGE HORNER: Yes.

MR. STRAIN: I would be inclined to read Coffinberry to suggest to me, if anything, that I would coat the exterior surface that is at the interface with the combustion chamber to avoid build-up of coke on that surface, and have that, therefore, interfere with the combustion process.

JUDGE HORNER: Okay.

MR. STRAIN: The --

JUDGE HORNER: That is helpful, thank you.

MR. STRAIN: At least it was clear to me, from reading the Coffinberry reference, that your concern about build-up of contaminant on walls, and then the subsequent flaking off of that, and then that interfering with combustion and other processes, and the discussions, for example, at the bottom of column four that we started out talking about, it says that "fluid containment articles that can benefit from the present invention may be any component which is adapted to contain or transport hot hydrocarbon fluid, and include, but are not limited to, conduits that heat fluid" -- just a second -- "conduits and heat exchangers. Examples of such containment articles are those with surfaces through which heat is transferred from a heat source to a liquid hydrocarbon."

And it is generally referring to tanks, conduits, and enclosures that hold the material, was my interpretation. So I guess I will, if it's okay, move back to the Dam reference, since that was the first.

JUDGE HORNER: Sure.

MR. STRAIN: And, although -- well, the Dam reference is completely missing any discussion with respect to specific surface roughness ranges. And I will also point out that, while the Dam reference refers to the hardness of the materials that it uses, it defines a range of 1,000 kilograms per square millimeter or greater, our range is 1,500 to, I believe, 4,000.

JUDGE HORNER: To 4,500?

MR. STRAIN: To 4,500. So, the range starts at a point and then is open-ended to include everything above that.

The inventors, in this present application, were looking at the interplay specifically in fuel injectors between three variables: the surface hardness, the thickness of the layer, and the surface roughness, all of which are important in this context. Certainly above certain thickness ranges you begin to have flaking, and coatings can begin to fail. The surface roughness has an impact on overall efficiency and on the stress on the coating, the surface roughness, the less stress and strain that could, again, cause a fault in the coating, and cause the coating to flake off.

And the hardness has an impact, as well. If something isn't hard it can stick, and that's not something that you want to have in fuel injectors. My initial research was – for the patent that got me started down this path -- was into failure modes of fuel injectors. And they can fail in two modes. The first mode is they stick open, and the other mode is they stick shut. Neither

one is good. If it sticks open, it fills up the cylinder in the engine block, you get hydraulic lock, and the entire engine block is gone. In the other mode, your engine efficiency is very bad. You will start to hear knocking.

So, the Dam reference is completely silent, with respect to the claim range of surface roughnesses. There is nothing in the reference, and the only discussion about having a smooth surface really comes at the beginning, in the background section, and relates ultimately to catastrophic failure of the fuel injector. If the fuel injector is leaking fluid through the valve, eventually the entire cylinder in the engine block is going to fill up with fluid. You will get hydraulic lock, and you will break the entire engine block.

So, the discussion with respect to surface roughness really is along the lines of saying that we don't want catastrophic failure, but doesn't rise to a level of specificity to really meet this claimed element of our present claims.

The examiner engaged briefly in an exercise of attempting to argue that the surface roughness was inherent in the Dam reference, on the grounds that he had thought that he had found the hardness and he had found the coating thickness, and that, necessarily, the claimed range of surface roughness would follow. That is not the case. This isn't an empirical truth: if you have hardness and you have a coating thickness, then it must necessarily have a given surface roughness. You could have a surface that had major grooves in the surface that would meet a thickness requirement and a hardness requirement. But on a macro-level, it simply would not have surface roughness within the claimed range.

Did you have any questions on that point?

JUDGE HORNER: I have one question on the surface roughness, generally. I see in the spec that the surface roughness of the base material, before being coated with the hard carbon thin film, influences the surface roughness of the thin film after being formed on the base material, because the thickness of the film is so small.

So, why wouldn't a discussion in Dam of the surface roughness, or in that -- in the case of Dam, the smoothness of the underlying material, be relevant here?

MR. STRAIN: A discussion of that would be of some relevance. It's just not sufficiently specific to tell us what it is. What is smooth for one person may not be smooth for another. If -- and so, it is -- without more, there is nothing here to suggest that the surface roughness, in fact, falls within what would be the claimed range, because of the subsequent coating process.

JUDGE O'NEILL: What is, technically, the claimed range? Because it is actually –

MR. STRAIN: The formula defines the interplay between the three parameters.

JUDGE O'NEILL: Okay.

MR. STRAIN: And the claimed range would be, then, limited to those parameters we have defined within claim one, the range of permissible -- hardnesses in the range of permissible thicknesses. So you could take the maximum from that, and assign a maximum value to the surface roughness.

But the formula A, those parameters must be met. So, for a given coating, or for a given base material that has the coating on it, so long as the

hardness parameter and the thickness parameter values can be plugged in, and the surface roughness is less than whatever that is calculated to be, then that would -- that condition would be met.

But all three have to be considered together. It's not simply a matter of finding each variable individually, and then saying that it has been met. The formula requires a relationship between the three.

Turning back, if we can, to the Coffinberry reference, there were a couple of other points that I wanted to make. The first is that the Coffinberry reference discusses two distinct embodiments, a first embodiment and a second embodiment.

In the first embodiment, in looking at figure 1 to guide the discussion, figure 1 shows a substrate 12, along with two coating layers that are designated by reference numerals 16 and 18. Reference numeral 16 is defined in the specification as being a metal or metal oxide tie layer, and top layer 18 is defined as a pure metal or a metal/metal layer, as a surface layer in embodiment 1.

In embodiment 2, there is a single layer, 14, which is a hard carbon layer, or a metal carbon layer. The values that are disclosed within Coffinberry, and on which the examiner relies for surface roughness and layer thickness, are disclosed in connection with the first embodiment only, and there is no disclosure whatsoever in the Coffinberry reference with respect to the thickness of a carbon layer or the surface roughness of a carbon layer.

If you look, for example, at -- there are two points where the specification clearly delineates between first and second embodiment. The first point is in what is -- let me just check the heading -- the summary of the invention section in column 3 at line 52. The paragraph begins, "In one embodiment of the invention" -- that's a reference to the first embodiment. And then, in the subsequent paragraph, which begins at column four, line four, the specification says, "In a second embodiment of the invention," and then goes on to describe carbon compositions.

The second point where the specification clearly delineates between the first and second embodiments is in column 6 at line 24. It appears that perhaps there should have been a paragraph break there, but there is not in the printed version of the patent. At the end of line 26 it begins, "In a first embodiment of this invention." And then, at column 6 at line 45, the paragraph begins, "A preferred coating 14 for this embodiment," and it then goes on to then described preferred metal oxides for the diffusion barrier layer 16, including amorphous tantala, tantalum oxide, and silica, silicon dioxide deposited to a thickness of at least about .5 micrometers, which effectively inhibits or eliminates diffusion of metal ions through the coating 14.

A preferred composition for the surface layer 18 is a substantially pure metal or metal/metal compound deposited to a thickness of at least about .5. The overall thickness of the coating 14, layer 16 and 18 combined, is preferably not greater than about 2 micrometers. You reduce the tendency of spillation due to thermal stress.

JUDGE HORNER: I thought the examiner was relying on surface layer 18 as the hard carbon thin film, and he pointed to column 7 -- at the top

of column 7, line 3 -- where it's talking about, "The surface layer 18 contains carbon in a diamond-like state."

MR. STRAIN: The examiner is referring to a carbon layer. But for that carbon layer 18, the specification includes no guidance as to thickness or hardness.

JUDGE HORNER: I thought it did on column six, around, let's see -- it talks about –

MR. STRAIN: Beginning at line 45, perhaps?

JUDGE HORNER: Line 53.

MR. STRAIN: That is with respect to the first embodiment.

JUDGE HORNER: Okay.

MR. STRAIN: The discussion of which begins in the immediately preceding paragraph, at line 26. And it is clear, when you go to line 60, "According to a second embodiment of this invention" --

JUDGE HORNER: Okay.

MR. STRAIN: -- that we have shifted gears –

JUDGE HORNER: I see.

MR. STRAIN: -- from a pure metal layer, or a metal/metal alloy layer, to the carbon layer. And metallic materials are going to have different hardness characteristics, the deposition process is going to result in different characteristics, perhaps, with respect to the surface roughness.

JUDGE HORNER: Okay.

MR. STRAIN: And the carbon layer that's discussed in connection with the second embodiment, there is no expressed guidance in the specification as to appropriate thickness levels, or as to appropriate hardnesses.

JUDGE HORNER: Okay.

MR. STRAIN: Or surface roughnesses. So, while the specification is completely devoid of any discussion of -- this is Coffinberry – of hardness, there is also, with respect to the one embodiment in the disclosure that does describe hard carbon films, no discussion of the actual thickness of that layer, and no discussion of the surface roughness of that layer.

JUDGE HORNER: And the only discussion of hardness I could find was -- for that second embodiment -- was referring to those three patents that were incorporated by reference.

MR. STRAIN: Right.

JUDGE HORNER: And one of them, I believe, gave some measure of hardness as greater than 200 kilograms per millimeters squared, which is not within your range.

MR. STRAIN: Right.

JUDGE HORNER: Okay.

MR. STRAIN: So, we've spoken generally about the Dam reference and the Coffinberry reference. The examiner has cited a secondary reference, but it simply adds nothing that resolves the fundamental deficiencies that we have discussed, with respect to Coffinberry.

JUDGE HORNER: Okay.

MR. STRAIN: Are there any other points that I can address for you?

JUDGE HORNER: No. Any further questions?

JUDGE O'NEILL: I think -- give me one minute.

(Pause.)

JUDGE O'NEILL: I have no further questions.

JUDGE HORNER: Okay. Great. Thanks for your time.

MR. STRAIN: Thank you very much for your time.

(Whereupon, at approximately 1:50 p.m., the proceedings were concluded.)